附件 2-1　E-NNOVATE 2025 波兰国际创新展览会线上展

发明项目展板英文图片内容(一)

CAI No. 07-1

Invention: Intelligent Ship Screening and Stowage Method for Multiple Offshore Modules　　多海工模块海运船舶智能筛选与配载技术

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Patent No.: CN202110149883.2, CN201810089151.7, CN202110149868.8.

Introduction：

Due to the diverse shapes, overweight mass, and large volume of offshore engineering modules, their maritime transportation loading has always been a complex and rule-intensive task, often requiring significant labor costs. The reasonable selection of shipping resources and cargo arrangement are crucial links and key technologies in maritime transportation loading. Our project team has developed a set of intelligent ship selection and loading technology for multi-offshore engineering module maritime transportation that aligns with engineering practice. By innovatively proposing the "secondary screening-secondary sorting" method and the "corner-skyline" loading algorithm, we have established a comprehensive loading solution from ship selection to cargo arrangement.

- Advantages and significance of the invention:

1) Innovative ship resource screening method: To achieve rapid ship resource screening, we innovatively propose the "secondary screening-secondary sorting" method. Through multiple screenings and sorting, ship resources can be quickly and accurately located (Fig 1). Based on the embedded ship resource database and cargo set information, the loading dimensions are obtained through the minimum bounding rectangle of the cargo. Available ships are selected through dual screening of weight and dimensions. Through secondary sorting based on spatial flatness and transportation costs, combined with corner point fission during loading, ships are initially sorted and then sorted again based on transportation costs. The ANN intelligent algorithm is applied to store loading information and ship information in model training. When the sample size is sufficient, the optimal ship sorting can be directly obtained, reducing algorithm operation costs. This method is simple and feasible, breaking through the existing design mode relying on designers' experience and repetitive "trial and error", optimizing design schemes, and improving overall efficiency.
2) Intelligent cargo loading solution: We have constructed an intelligent cargo loading solution based on genetic/heuristic algorithms and the corner-skyline algorithm (Fig 2). Through research on various loading conditions, we innovatively propose using genetic algorithms and heuristic algorithms to solve loading problems under different cargo quantities and spatial complexities. While considering algorithm speed, we ensure the

accuracy and usability of loading results. Constraint conditions are simplified through grayscale maps, and the corner-skyline algorithm is used to achieve the densest cargo arrangement under various algorithm conditions.

3) Development of wind power intelligent loading system: We have developed a wind power intelligent loading system to achieve rapid ship selection and loading for wind power module cargo (Fig 3). The system is directly embedded in the company's original data information platform, integrating four modules: ship resource screening, intelligent cargo loading, loading/unloading design, and loading drawing output. It integrates the whole process decision-making functions of cost estimation, module loading design, and loading/unloading transportation planning for wind power module transportation. It achieves multi-department collaborative office work and data transmission, and allocates computing resources.

- Application and Economic Benefits:

Based on this invention, we have published one academic work, obtained three authorized invention patents, and three software copyrights. This invention has been fully applied in demonstration projects of companies such as CNOOC and COSCO. It reduces annual personnel input costs by over 30 million CNY and creates over 3 billion CNY in benefits through voyage cost savings, demonstrating broad prospects (Fig 4)

- Development prospects:

Based on this invention, it can not only solve cargo loading in traditional maritime transportation processes, such as offshore engineering modules, wind power equipment, ship modules, engineering vehicles, pulp bales, etc., but also solve related problems in other logistics fields such as warehouse cargo arrangement and aircraft cabin cargo loading. By setting complex constraint conditions, it can even complete product layout design, such as circuit arrangement of micro-robots, showing its wide range of applications.

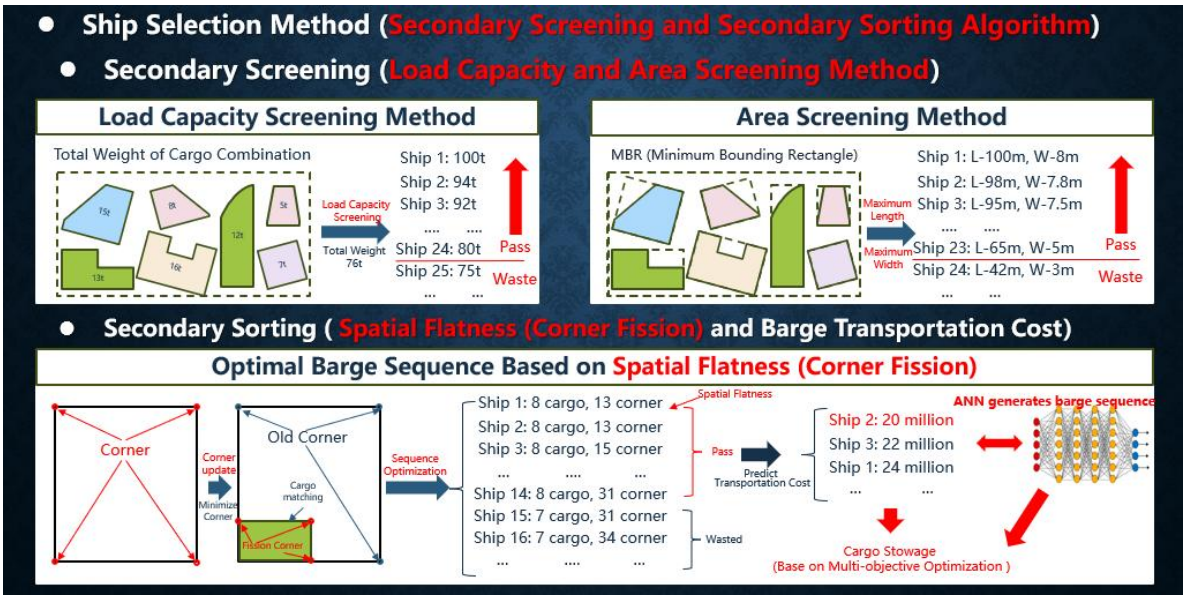

Fig 1 A Rapid Ship Resource Screening Method Based on Secondary Screening and Secondary Sorting

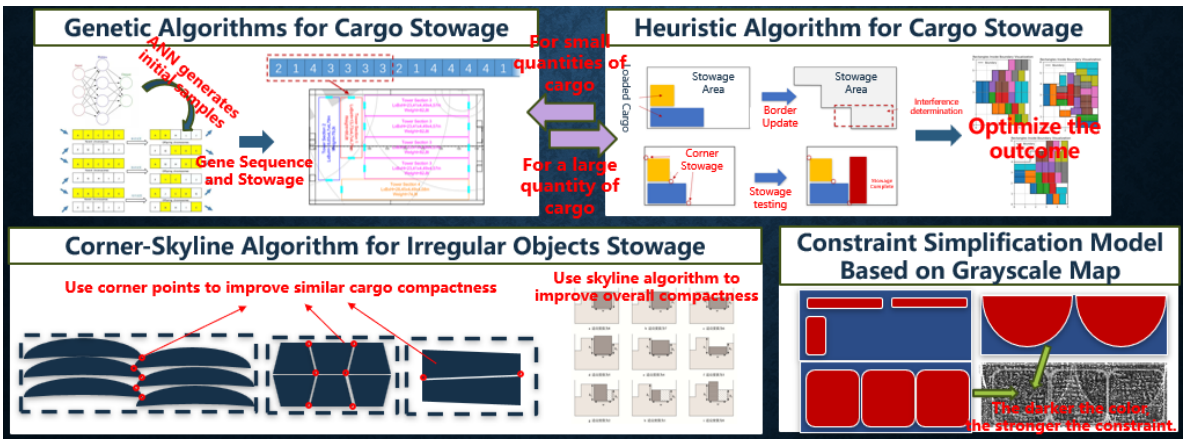

Fig 2 Fast Cargo Stowage Method Based on Intelligent Algorithm and Corner-Skyline Algorithm

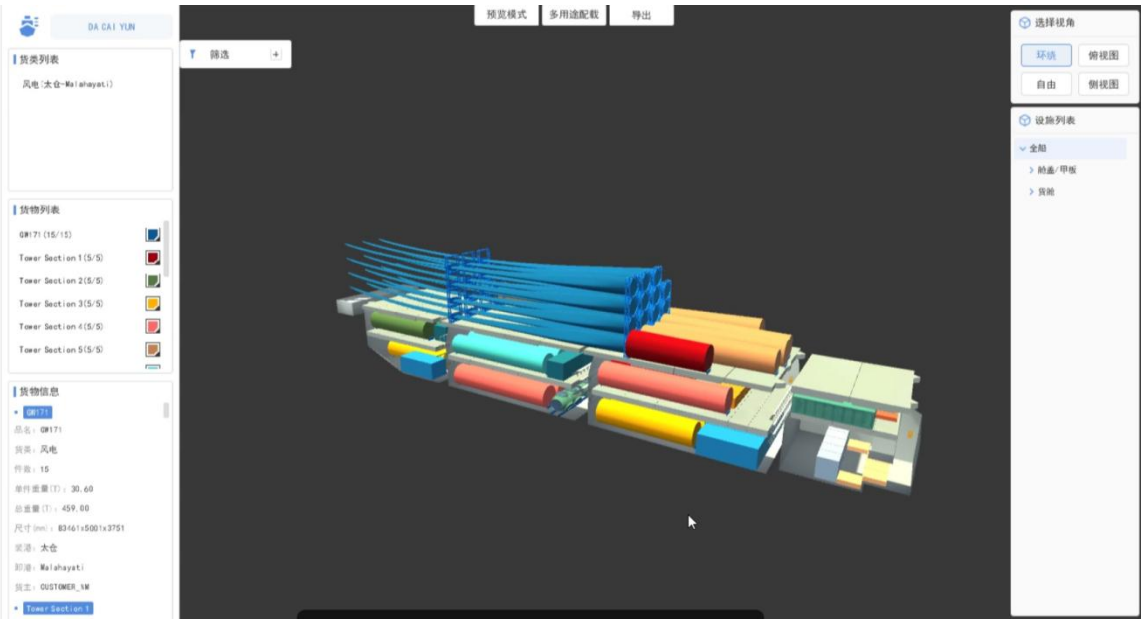

Fig 3 Wind Power Module Intelligent Loading System

Fig 4 Research Achievements and Application Status

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附件 2-2　E-NNOVATE 2025 波兰国际创新展览会线上展

CAI No. 07-2

单位/公司介绍展板英文、图片内容（二）

Tianjin University (TJU)

Introduction：

Tianjin University (TJU), founded on October 2, 1895, as Peiyang University, is China's first modern university and a pioneer of modern Chinese higher education (Fig. 1).

TJU achieved the following rankings (Fig. 2):

- QS World University Rankings 2024: 269th (11th in China);
- Times Higher Education (THE) World University Rankings 2025: 201- 250th (16th in China);
- Best Chinese Universities Ranking 2024: 20th;
- Chinese University Engineering Strength Rating 2024: 10th.

TJU has 15 disciplines ranked in the top 1% of the Essential Science Indicators (ESI) database, including 5 in the top 1‰ and 2 (Engineering and Chemistry) in the top 0.1‰.

This invention is developed based on national research platforms at Tianjin University, including the National Facility for Earthquake Engineering Simulation and the State Key Laboratory of Hydraulic Engineering Intelligent Construction and Operation (Fig. 3).

The school adheres to the principle of opening up to the world and deepening international exchanges and cooperation in an all-round way. TJU has cooperated with 260 universities, research institutes, and companies in 50 countries and regions.

For a long time, through the unremitting efforts of all teachers and students, Tianjin University has become a high-level research university with strong faculty, distinctive discipline characteristics, first-class education quality, and scientific research level in China, and a significant influence in the world.

Campus

Tianjin University Gate

Jingye Lake

Qiushi pavilion

The 9th teaching building

Top view

Main Building

Zhengdong Library

Beiyang Memorial Pavilion

STATISTICAL DATA

- Occupied area: 4.107 million m²
- Number of staffs: 4830
- Number of professors: 1025
- Number of full-time students: 40277
- Number of undergraduate majors: 76
- Number of master 's degrees: 48
- Number of doctoral programs: 38
- Number of postdoctoral research stations: 37
- Number of national key laboratories: 11
- Number of national engineering technology research centers: 5
- Number of international science and technology cooperation bases: 3
- Number of Key Research Platforms: 142

269th
QS World University Rankings 2024

201-250th
Times Higher Education (THE) World University Rankings 2025

20th & 10th
China's RANKING Universities Rankings & Engineering Strength Ratings 2024

Essential Science Indicators (ESI)
- 15 disciplines in the top 1%
- 5 disciplines in the top 1‰
- 2 disciplines in the top 0.1‰

National Facility for Earthquake Engineering Simulation

State key laboratories

International Qualification

The Intelligent Lashing and Securing Team
(group photo taken after the degree conferral ceremony)

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